



Water and Wastewater Study
Combined

Basis of Design Report

Water

Deer Valley Townhomes

NWC of Miller Road & Deer Valley Road

City of Scottsdale

Maricopa County, Arizona

TSC Project No. 0800

July 2019

Prepared for:

Beardsley 22, Inc
222 W Linger Lane,
Phoenix, AZ 85021

FINAL Basis of Design Report

☒ APPROVED

☐ APPROVED AS NOTED

☐ REVISE AND RESUBMIT



Disclaimer: If approved; the approval is granted under the condition that the final construction documents submitted for city review will match the information herein. Any subsequent changes in the water or sewer design that materially impact design criteria or standards will require re-analysis, re-submittal, and approval of a revised basis of design report prior to the plan review submission.; this approval is not a guarantee of construction document acceptance. For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY scan

DATE 9/10/2019



EXPIRES 12/31/2019

Table of Contents

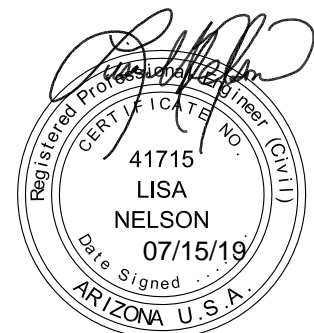
1.0 Introduction	1
2.0 Water System	1
3.0 Domestic Water Demand Calculations	2
4.0 Fire Flow Calculations	2

List of Figures

Figure 1: Location Map	1
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List of Appendices

Appendix A: Fire Flow Test
Appendix B: Grading & Drainage Plan
Appendix C: IFC – Appendix B



EXPIRES 12/31/2019



1.0 Introduction

The proposed Deer Valley Townhomes development (Project) consists of attached townhomes split between three (3) buildings on a one acre parcel. The Site is defined by the parcel boundary for APN# 212-02-010E and is located at the northwest corner of Miller Road and Deer Valley Road in Scottsdale (see figure 1 below). The current project zoning is PCOC and proposed project zoning is R-3. The site is currently undeveloped and the proposed development will be constructed all at once and will not be phased.

The purpose of this report is to evaluate the Site's existing and proposed water and fire infrastructure to determine if adequate supply is available. This report takes into consideration the projected water demand, fire demand, and its impact. The Project will be designed and developed in accordance with the City of Scottsdale amendment to the 2015 International Fire Code, 2018 City of Scottsdale Design Standards & Policies Manual (DSPM), County, and State requirements.

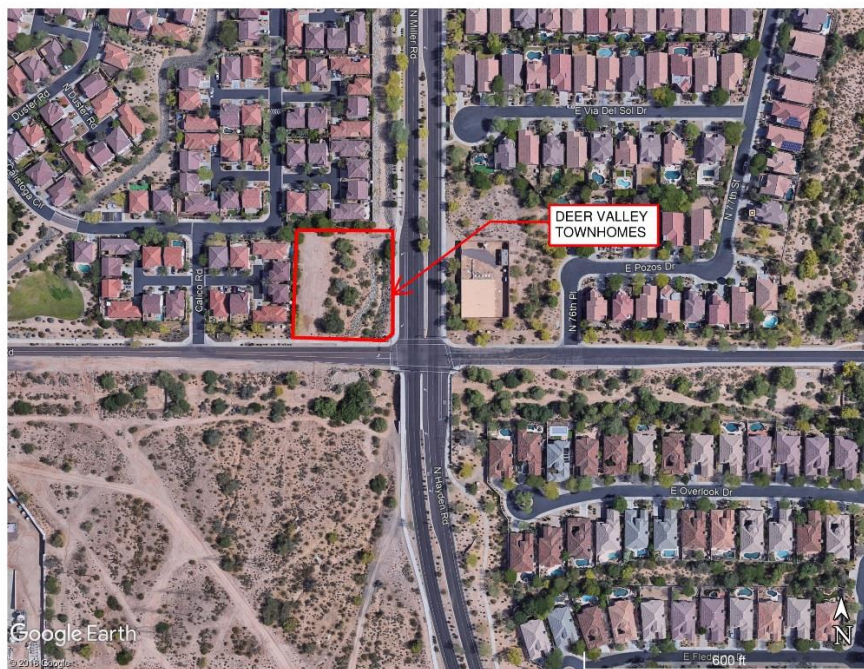


Figure 1: Location Map

2.0 Water System

The Site is a vacant lot with a channel along the east side. There are existing water lines in Deer Valley Road and Miller Road. City quarter section maps show various water lines along Miller Road that continue west on Deer Valley Road, which may be raw water or transmission mains but do not negatively impact the Site. There

appears to be a water tank on the south side of Deer Valley Road. An 8" D.I.P. water line exists in Calistoga Circle within the Arizona Silverado subdivision. This line is located at the northwest corner of the Site with a service line that extends to the site with a blowoff at the end of the line.

A water meter is proposed at the northwest corner of the property within the existing City utility and drainage easement shown on the Arizona Silverado Final Plat. The meter size is estimated at 1-½", but will need to be confirmed during the construction document phase. A 1-½" domestic water line is estimated at this time to service the Site, with individual connections to each home. During final design, it may be determined that each structure requires one domestic service not one per home. Considering the residual pressure of 96 psi along Deer Valley Road, a pressure reducing valve may be required for the domestic supply. See **Appendix A** for flow test results.

3.0 Domestic Water Demand Calculations

Unit Count = 9

Average Day Flow (ADF) = $9 \times 227.6 \text{ gpd/unit} = 2,048.4 \text{ gpd} =$
 $2,048.4 \text{ gpd} / 1440 (\text{min/day}) = 1.42 \text{ gpm}$

Maximum Day Flow (MDF) = $\text{ADF} \times 2.0 = 1.42 \text{ gpm} \times 2.0 = 2.84 \text{ gpm}$

Peak Hour Flow (PHF) = $\text{ADF} \times 3.5 = 1.42 \text{ gpm} \times 3.5 = 4.97 \text{ gpm}$

*ADF based on DSPM figure 6-1.2

*MDF and PHF based on DSPM section 6-1.404.B

4.0 Fire Flow Calculations

The Project falls within the City of Scottsdale service boundary in Pressure Zone 6. There is an existing hydrant south of the Site at the northwest corner of the headwall for the culvert under Deer Valley Road. This hydrant is to be relocated west of the proposed driveway into the site. An additional hydrant is proposed at the northwest corner to meet hose lay requirement for the northernmost structure.

According to DSPM Section 6-1.501, a minimum system fire flow of 1,500 gpm is required for commercial, industrial, and multi-family residential developments. The largest structure on site has a footprint of 6,100 sf and does not contain fire walls. Upon final determination of the building construction type being classified as V-A, **Appendix B** of the 2015 International Fire Code indicates the fire flow demand is 1,500 for a duration of two hours. The flow tests provided in **Appendix A** show that the supply meets the demand requirements.

APPENDIX A
FIRE FLOW TEST



Flow Test Summary

Project Name: EJFT 18159
Project Address: 7601 E Deer Valley Rd, Scottsdale, AZ 85255
Date of Flow Test: 2018-07-09
Time of Flow Test: 7:30 AM
Data Reliable Until: 2019-01-09
Conducted By: Tayler Lynch & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By: Jim Demarbiex (City of Scottsdale) 602.541.0586
City Forces Contacted: City of Scottsdale (602.228.2187)
Permit Number: C55801

Note Scottsdale requires a max static pressure of 72 psi for safety factor

Raw Flow Test Data

Static Pressure: 100.0 PSI
Residual Pressure: 96.0 PSI
Flowing GPM: 2,455
GPM @ 20 PSI: 12,378


Data with a 28 PSI Safety Factor

Static Pressure: 72.0 PSI
Residual Pressure: 68.0 PSI
Flowing GPM: 2,455
GPM @ 20 PSI: 9,809

Hydrant F₁

Pitot Pressure (1): 52 PSI
Coefficient of Discharge (1): 0.9
Hydrant Orifice Diameter (1): 2.5 inches
Pitot Pressure (2): 55 PSI
Coefficient of Discharge (2): 0.9
Hydrant Orifice Diameter (2): 2.5 inches



 Static-Residual Hydrant

 Flow Hydrant

Distance Between F₁ and R
287 ft (measured linearly)

Static-Residual Elevation
1771 ft (above sea level)

Flow Hydrant (F₁) Elevation
1774 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC

21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915
www.flowtestsummary.com

Page 1

43-DR-2019
08/14/19

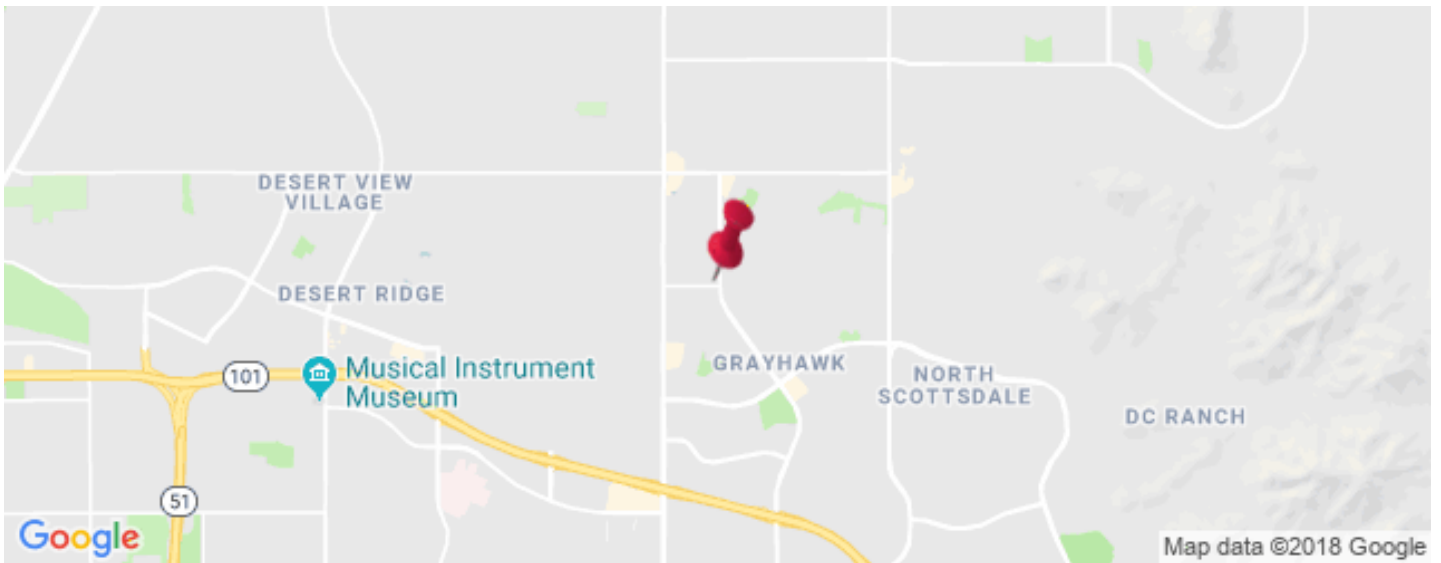
Static-Residual Hydrant



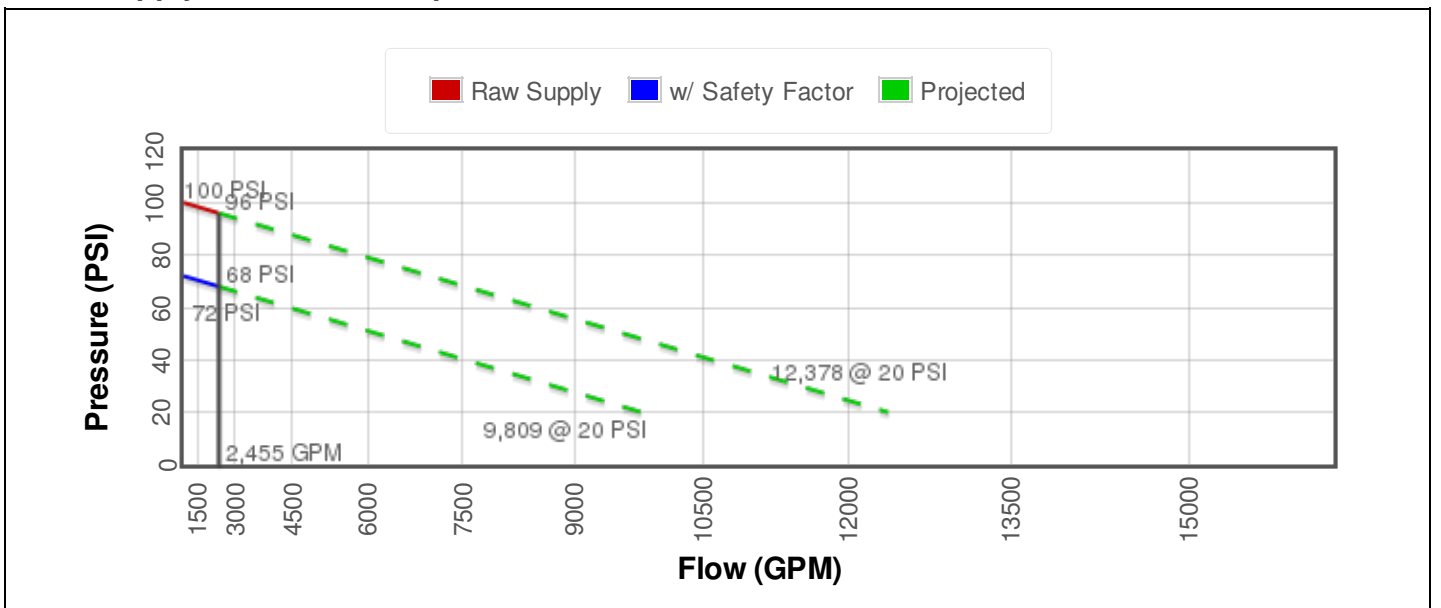
Flow Hydrant (only hydrant F1 shown for clarity)



Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



APPENDIX B
PRELIMINARY GRADING & DRAINAGE PLAN

Flow	
Q= CIA**	Q = Flow (cfs)
Q = 0.94 x 8.05 x 0.68	C = Average Runoff Coefficient*
Q = 5.15 cfs	I = Precipitation Intensity (100-yr, 5-min) (in/hr)
	A = Net Area of Disturbed Area (ac)

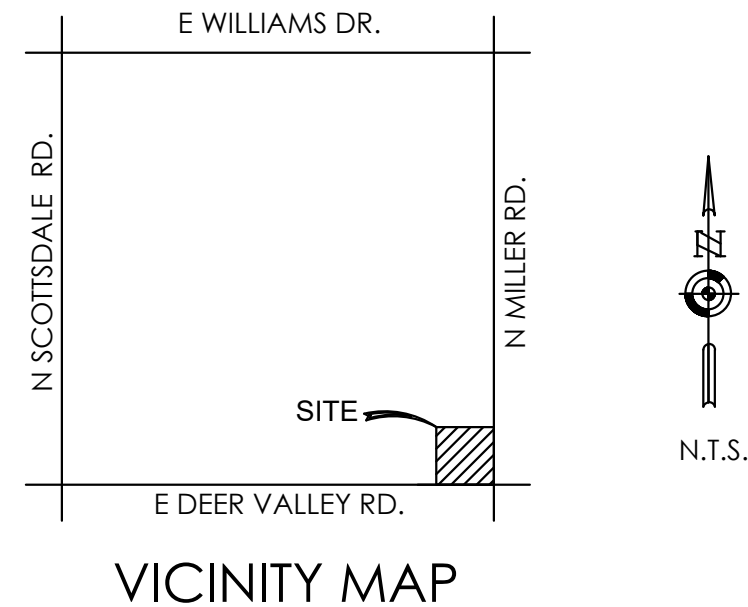
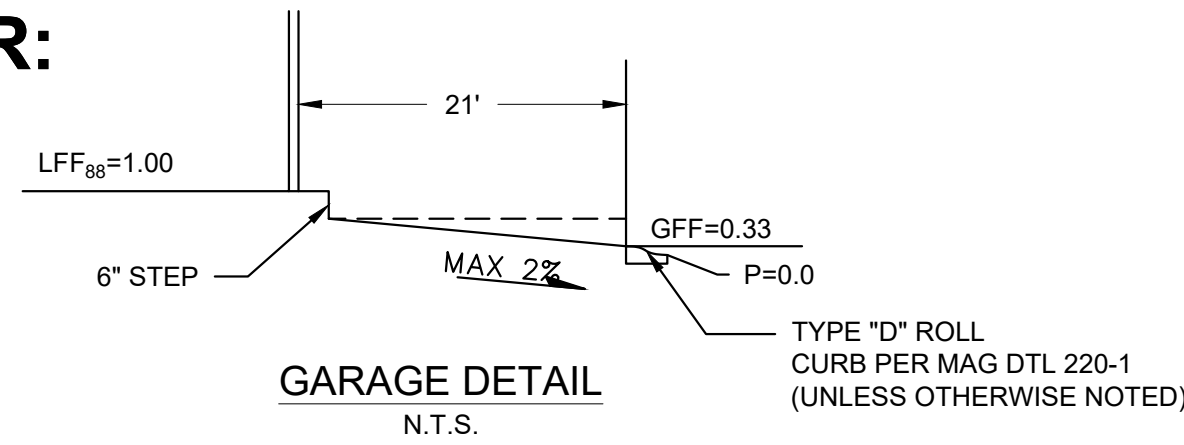
*C-Values are from FCDMC Hydrology Manual

First Flush Volume	
V= CDA**	V = First Flush Volume (cf)
V = 0.94 x 0.042 x 29,597	C = Average Runoff Coefficient*
V = 1,168 cf	D = First Flush Precipitation Depth (1/2") (ft)
	A = Net Area of Disturbed Area (sf)

*C-Values are from FCDMC Hydrology Manual
**First Flush equation is from COS Design Manual

PRELIMINARY GRADING AND DRAINAGE PLAN FOR: DEER VALLEY TOWNHOMES N MILLER ROAD & E DEER VALLEY ROAD SCOTTSDALE, ARIZONA

A PORTION OF THE SOUTHWEST QUARTER OF SECTION 14, TOWNSHIP 4 NORTH, RANGE 4 EAST OF THE
GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA.



OWNER / DEVELOPER

BEARDSLEY 22, INC
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CONTACT: SCOTT WARD
PHONE: (480) 899-4330
EMAIL: WARDDEVELOPMENT@YAHOO.COM

ARCHITECT

WHITNEYBELL PERRY, INC
575 W CHANDLER BLVD, SUITE 123
CHANDLER, ARIZONA 85224

CONTACT: TERESA HILL
PHONE: (480) 857-8364
EMAIL: TERESA@WHITNEYBELLPERRY.COM

CIVIL ENGINEER

TERRASCAPE CONSULTING
1102 EAST MISSOURI AVENUE
PHOENIX, ARIZONA 85014

CONTACT: LISA NELSON, P.E.
PHONE: (480) 454-1807
FAX: (602) 230-2458
EMAIL: LNELSON@TERRASCAPE.US

PROJECT DATA:

APN: 212-02-010E
NET AREA: 0.68 ACRES
TOTAL DISTURBED AREA: 0.68 ACRES
PARCEL AREA: 1.00 ACRES

ADDRESS: 21818 N MILLER RD,
SCOTTSDALE, AZ 85255

BASIS OF BEARING

THE SOUTH LINE OF SECTION 14, TOWNSHIP 4 NORTH, RANGE 4 EAST. SAID LINE HAVING AN ASSUMED BEARING OF N 89° 32' 09" E.

BENCHMARK

A CITY OF SCOTTSDALE BRASS CAP IN HANDHOLE AT THE INTERSECTION OF SCOTTSDALE ROAD AND DEER VALLEY ROAD, C.O.S ELEVATION = 1747.03 (NAVD 88).

FEMA FLOOD INFORMATION

FLOOD ZONE DESIGNATION "X" F.E.M.A. FLOOD INSURANCE RATE MAP, MAP NUMBER 04013C1320L, PANEL 1320 OF 4425, DATED AUGUST 25, 2017. ZONE "X" AREAS DETERMINED TO BE OUTSIDE OF 0.2% ANNUAL CHANCE FLOODPLAIN.

LEGEND

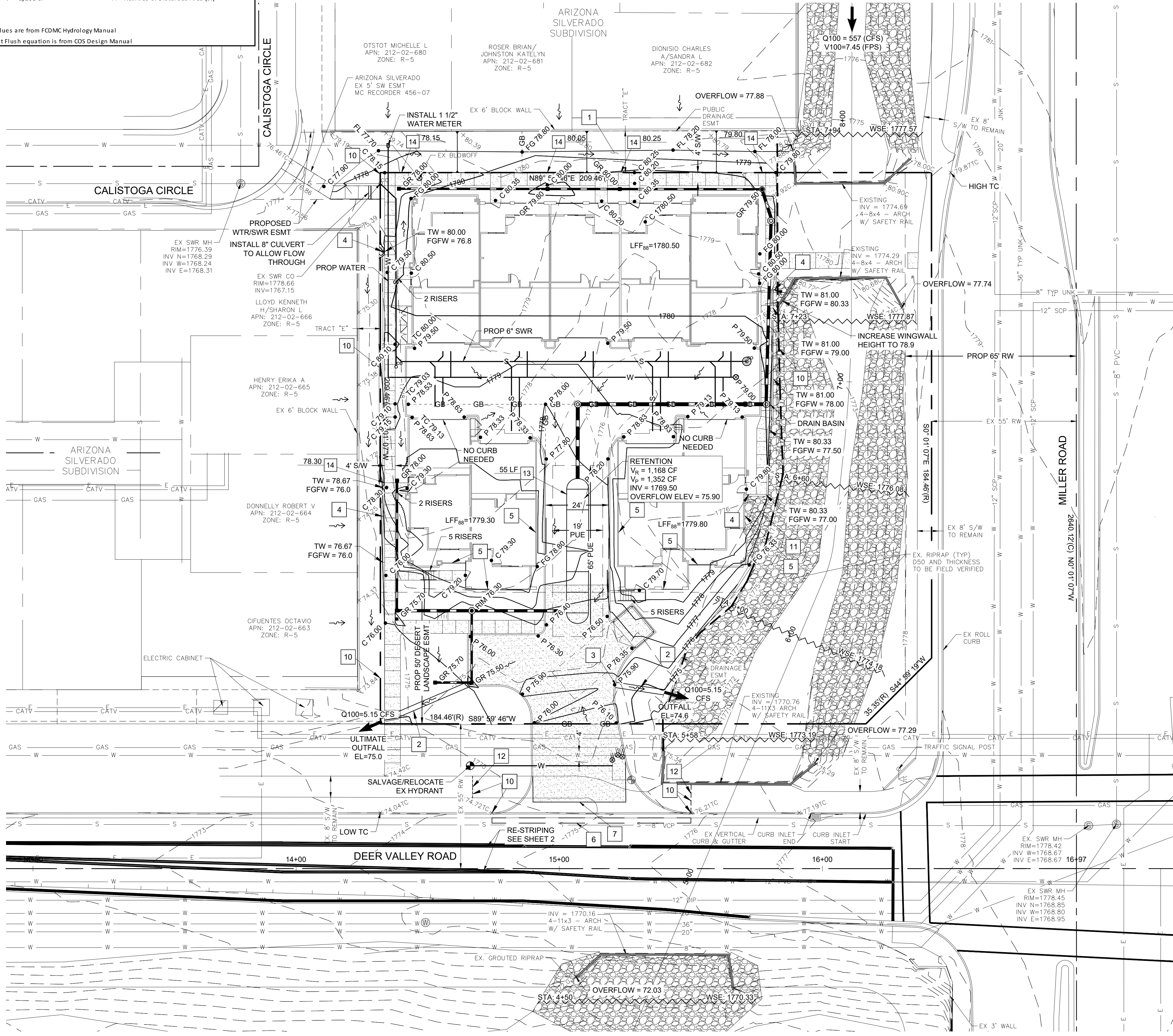
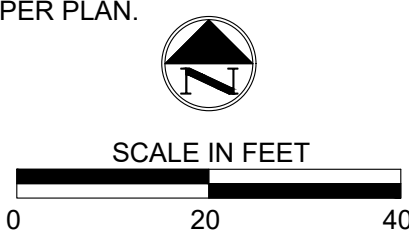
---	BOUNDARY	⊙	FIRE HYDRANT
---	EX PROPERTY LINE	⊙	CLEAN OUT WITH COLLAR
---	SETBACK	⊙	CLEAN OUT
---	EASEMENT	⊙	VALVE
---	STORM DRAIN	⊙	4" MANHOLE
S---	SANITARY SEWER LINE	⊙	CATCH BASIN
W---	DOMESTIC WATERLINE	⊙	YARD DRAIN
FW---	FIRELINE	⊙	BACKFLOW PREVENTER
⊙	DRYWELL	⊙	WATER METER
⊙	STORMTECH RETENTION TANK	⊙	FINISHED GRADE
---	GB GRADE BREAK LINE	WSE	HEC-RAS CROSS SECTIONS WATER SURFACE ELEVATION
---	EROSION SETBACK	---	COLORLED PORTLAND CEMENT CONCRETE

ABBREVIATIONS

BLDG	BUILDING	LS	LANDSCAPE
C	CURB AND GUTTER	MH	MANHOLE
C&G	CURB AND GUTTER	P	PAVEMENT
CO	CLEAN OUT	PROP	PROPOSED
CMP	CORRUGATED METAL PIPE	PUE	PUBLIC UTILITY EASEMENT
DIA	DIAMETER	RW	RIGHT OF WAY
EL/ELEV	ELEVATION	SB	SETBACK
ESMT	EASEMENT	SS	SANITARY SEWER
EX	EXISTING	S/W	SIDEWALK
LFF ₈₈	FINISHED FLOOR ELEVATION	TC	TOP OF CURB
FGFW	FINISHED GRADE AT FOOT OF WALL	TYP	TYPICAL
FL	FLOWLINE	TW	TOP OF WALL
G	GUTTER	V ₆	VOLUME PROVIDED
GR	GRATE	V ₆	VOLUME REQUIRED
HP	HIGH POINT	WSE	WATER SURFACE ELEVATION
INV	INVERT		

PAVING, GRADING AND DRAINAGE NOTES

- GRADE TO DRAIN
- GRADE 4" WIDE DRAINAGE SWALE TO DRAIN; LINE WITH 4" DIA. LANDSCAPE ROCK.
- 2" WIDE CURB OPENING.
- RETAINING WALL WITH SAFETY RAIL. WALL HEIGHT VARIES, PER PLAN. WALL FOOTING SHALL EXTEND BELOW TOP OF BANK TURN DOWN FOR RIP RAP, WHERE APPLICABLE ALONG EX. CHANNEL.
- EXPOSED STEM WALL; REFER TO ARCHITECTURAL PLANS.
- MIN. 2" SAWCUT AND REMOVE EX. A.C.C.P. ROADWAY. PROTECT EXISTING ASPHALT CONCRETE TO REMAIN.
- INSTALL M-2 DRIVEWAY PER C.O.S. STD. DTL. 2255; SIDEWALK MODIFIED PER PLAN.
- WIDEN A.C.C.P. ROADWAY TO LIMITS SHOWN.
- OBLITERATE PAVEMENT MARKINGS
- MATCH EXISTING.
- 2" DEEP RIP RAP D50 = 6" TO BE INSTALLED AGAINST RETAINING; MATCH EXISTING
- SAWCUT, REMOVE, AND DISPOSE OF CONCRETE TO LIMITS SHOWN OR NEAREST EXPANSION JOINT, EXACT LIMITS TO BE DETERMINED IN THE FIELD. PROTECT EXISTING ASPHALT CONCRETE TO REMAIN.
- INSTALL MC3500 (45" ARCH PIPE) STORMTECH RETENTION SYSTEM. SEE DETAIL SHEET 2. LENGTH PER PLAN.
- LOCALIZED INLET OVERFLOW POINT. OVERFLOW ELEV. PER PLAN.



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consulting
Terrascope
civil engineering • surveying • urban planning

1102 East Missouri Ave., Phoenix, Arizona 85014 • 575 West Chandler Blvd. #123, Chandler, Arizona 85225
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EXPIRES 12/31/2019

DEER
VALLEY
TOWNHOMES

PRELIMINARY
GRADING & DRAINAGE



DATE	DESCRIPTION
08/27/18	CITY SUBMITTAL
02/06/19	CITY SUBMITTAL
03/25/19	CITY SUBMITTAL

CHECKED BY: LMN

DRAWN BY: CMA

TITLE: **PRELIMINARY
GRADING & DRAINAGE
PLAN**

SHEET No.

1 of 2

PROJECT No.
0800

3-ZN-2017

43-DR-2019
08/14/19

APPENDIX C

IFC – Appendix “B”

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.2 and B105.1(2).

TABLE B105.1(1)
REQUIRED FIRE-FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
0-3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0-3,600	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	500	1/2
3,601 and greater	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	1/2 value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

TABLE B105.2
REQUIRED FIRE-FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the <i>International Fire Code</i>	25% of the value in Table B105.1(2) ^a	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the <i>International Fire Code</i>	25% of the value in Table B105.1(2) ^b	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire-flow shall be not less than 1,000 gallons per minute.

b. The reduced fire-flow shall be not less than 1,500 gallons per minute.

LISTEN | DESIGN
PLAN | **BUILD**



Basis of Design Report for Water

Deer Valley Townhomes

NWC of Miller Road & Deer Valley Road

City of Scottsdale

Maricopa County, Arizona

City of Scottsdale Case Number: 43-DR-2019

TSC Project No. 0800

Submittal Date: Feb 18th, 2020

Revision Date: Jun 9th, 2020

Prepared for:

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480-899-4330

Prepared by:

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Phoenix, AZ 85014
480-454-1807
lnelson@terrascap.us

FINAL Basis of Design Report

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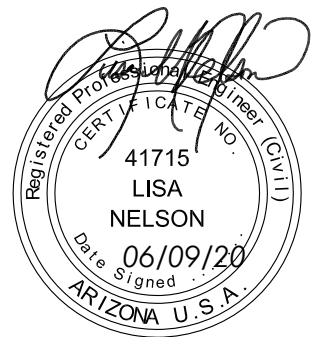


Table of Contents

1.0 Introduction	1
2.0 Water System.....	1
3.0 Domestic Water Demand Calculations	2
4.0 Fire Flow Calculations	2
5.0 Water Model Analysis	2
6.0 Conclusion	4

List of Figures

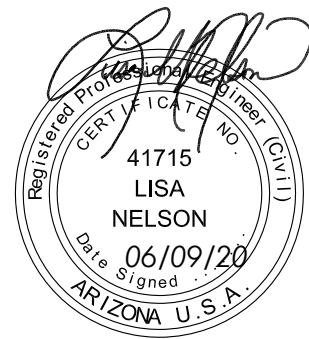
Figure 1: Vicinity Map	1
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List of Appendices

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Appendix B: Grading & Drainage Plan
Appendix C: IFC – Appendix B
Appendix D: WaterCAD Results

REFERANCES:

- 2018 City of Scottsdale Design Standards and Policies Manual – Chapter 6 (Water)
- International Fire Code 2015



1.0 Introduction

The proposed Deer Valley Townhomes development (Project) consists of attached townhomes split between three (3) buildings, 9 units on a one acre parcel. The proposed total disturbed area is 0.68 acres which include approximate 12,332 SF of building area. The lowest finished floor elevation of the site is 1779. The Site is defined by the parcel boundary for APN# 212-02-010E and is located at the northwest corner of Miller Road and Deer Valley Road in Scottsdale (see figure 1 below). The project zoning is R-3. The Site is currently undeveloped and the proposed development will be constructed all at once and will not be phased.

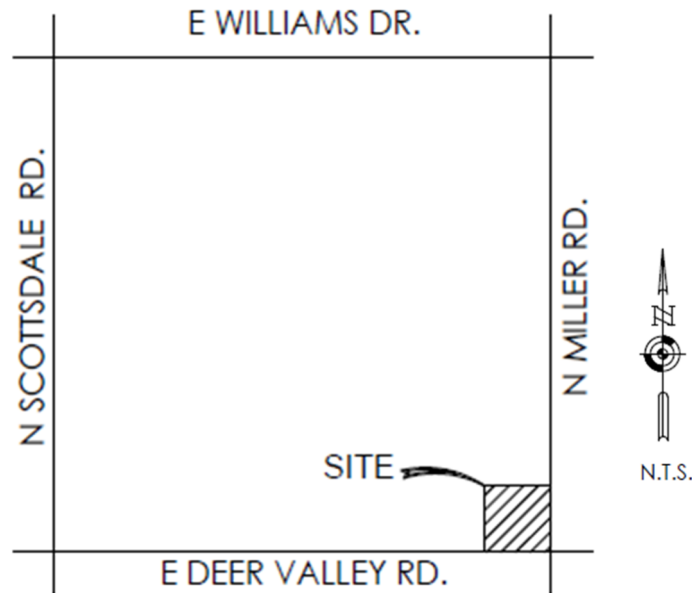


Figure 1 Vicinity Map

The purpose of this report is to evaluate the Site's existing and proposed water and fire infrastructure to determine if adequate supply is available. This report takes into consideration the projected water demand, fire demand, and its impact. The Project will be designed and developed in accordance with the City of Scottsdale amendment to the 2015 International Fire Code, 2018 City of Scottsdale Design Standards & Policies Manual (DSPM), County, and State requirements.

2.0 Water System

The Site is a vacant lot with a channel along the east side. There are existing water lines in Deer Valley Road and Miller Road. City quarter section maps show various water lines along Miller Road that continue west on Deer Valley Road, which may be raw water or transmission mains but do not negatively impact the Site. There appears to be a water tank on the south side of Deer Valley Road. An 8" D.I.P. water line exists in Calistoga Circle within the Arizona Silverado subdivision. This line is

located at the northwest corner of the Site with a service line that extends to the site with a blowoff at the end of the line.

A water meter with backflow prevention is proposed to the east of the property main entrance within the City right of way. The meter size is proposed as 1.5", but will need to be confirmed during the construction document phase. A 2" domestic water line is proposed North from the meter to the units, with individual 1" water service connections to each home. During final design, it may be determined that each structure requires one domestic service not one per home. Considering the residual pressure of 96 psi along Deer Valley Road, a pressure reducing valve will be proposed for the domestic supply. See Appendix A for flow test results.

3.0 Domestic Water Demand Calculations

Unit Count = 9

Average Day Demand (ADD) = $9 \times 0.33 \text{ GPM/unit} = 2.97 \text{ GPM}$

Maximum Day Demand (MDD) = $\text{ADD} \times 2.0 = 2.97 \text{ GPM} \times 2.0 = 5.94 \text{ GPM}$

Peak Hour Demand (PHD) = $\text{ADD} \times 3.5 = 2.97 \text{ GPM} \times 3.5 = 10.40 \text{ GPM}$

*ADD based on DSPM figure 6-1.2

*MDD and PHD based on DSPM section 6-1.404.B

4.0 Fire Flow Calculations

The Project falls within the City of Scottsdale service boundary in Pressure Zone 6. There is an existing hydrant south of the Site at the northwest corner of the headwall for the culvert under Deer Valley Road. This hydrant is to be relocated west of the proposed driveway into the site. An 8" fire line into the Site is proposed to connect to existing water line in Deer Valley Road. A shut off valve is proposed on the existing water main as requested by the City.

According to DSPM Section 6-1.501, a minimum system fire flow of 1,500 GPM is required for commercial, industrial, and multi-family residential developments. Per the architect, Whitneybell Perry, the largest structure on site contains a fire wall from first to second floor, which results in a maximum effective area of 5,568 SF for the fire demand calculation. The building construction type is classified as V-A. Appendix B of the 2015 International Fire Code indicates the fire flow demand is 1,500 for a duration of two hours (Refer to Appendix C). The flow tests provided in Appendix A shows that the supply meets the demand requirements.

5.0 Water Model Analysis

To better simulate the demand conditions, a water model was created using Bentley WaterCAD software. Terrascope Consulting established the following design parameter and assumptions based on the City of Scottsdale Design Standards:

- Maximum Velocity: 10 fps
- Hazan-Williams roughness coefficient: 150 for PVC, 130 for DIP
- Pressure limits: min. 30 psi for max Day + Fire Flow

Fire hydrant flow tests were performed by EJ Flow Test on July 9th, 2018 with results and hydrant locations provided in Appendix A. Because the actual static pressure exceeds 80 psi, a 28 psi safety factor was applied as required in the C.O.S. DSPM:

Static Pressure: 72 psi
Residual Pressure: 68 psi with 2,455 GPM
Minimum Residual Pressure: 20 psi with 9,809 GPM

Based on the provided pressures and flows from the fire hydrant flow test, a 3-point pump curve is created to support the water pressure and demand within the project.

Following the DSPM requirement, three scenarios were simulated including: Average Day, Peak Hour, and Max Day plus Fire Flow. The full output results from WaterCAD is provided in Appendix D with the water model network. The following tables present summaries of onsite junctions with highest/lowest pressures and pipes with highest velocity in each scenario.

Table 1: System Pressure Summary

Scenario	Junction with Max. Pressure	Pressure (psi)	Junction with Min. Pressure	Pressure (psi)
Avg. Day	D-1	65	D-2 to D-4	64
Peak Hour	D-1	65	D-2 to D-4	64
Max. Day+Fire Flow	D-1	63	F-3	52

Table 2: Pipe Velocity Summary

Scenario	Pipe with Max. Velocity	Velocity (fps)
Avg. Day	DW-1 to DW-3	0.30
Peak Hour	DW1 to DW-3	1.06
Max. Day+Fire Flow	FW-1 to FW-3	9.57



6.0 Conclusion

Based on the results of the WaterCAD model, the water system meets the 2018 City of Scottsdale Design Standards and Policies Manual. The proposed system is able to adequately provide Average Day, Peak Hour and Max Day plus Fire Flow demand. Flow and pressure throughout the system during all design conditions meet or exceed minimum pressure requirements. According to the proposed water demand from the project and the water model, the Site will not have adverse effects on the City water main and service to the surrounding areas.



APPENDIX A
FIRE FLOW TEST



Flow Test Summary

Project Name: EJFT 18159
Project Address: 7601 E Deer Valley Rd, Scottsdale, AZ 85255
Date of Flow Test: 2018-07-09
Time of Flow Test: 7:30 AM
Data Reliable Until: 2019-01-09
Conducted By: Tayler Lynch & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By: Jim Demarbiex (City of Scottsdale) 602.541.0586
City Forces Contacted: City of Scottsdale (602.228.2187)
Permit Number: C55801

Note Scottsdale requires a max static pressure of 72 psi for safety factor

Raw Flow Test Data

Static Pressure: 100.0 PSI
Residual Pressure: 96.0 PSI
Flowing GPM: 2,455
GPM @ 20 PSI: 12,378


Data with a 28 PSI Safety Factor

Static Pressure: 72.0 PSI
Residual Pressure: 68.0 PSI
Flowing GPM: 2,455
GPM @ 20 PSI: 9,809

Hydrant F₁

Pitot Pressure (1): 52 PSI
Coefficient of Discharge (1): 0.9
Hydrant Orifice Diameter (1): 2.5 inches
Pitot Pressure (2): 55 PSI
Coefficient of Discharge (2): 0.9
Hydrant Orifice Diameter (2): 2.5 inches



 Static-Residual Hydrant

 Flow Hydrant

Distance Between F₁ and R
287 ft (measured linearly)

Static-Residual Elevation
1771 ft (above sea level)

Flow Hydrant (F₁) Elevation
1774 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC

21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

www.flowtestsummary.com

Page 1

43-DR-2019
6/25/2020

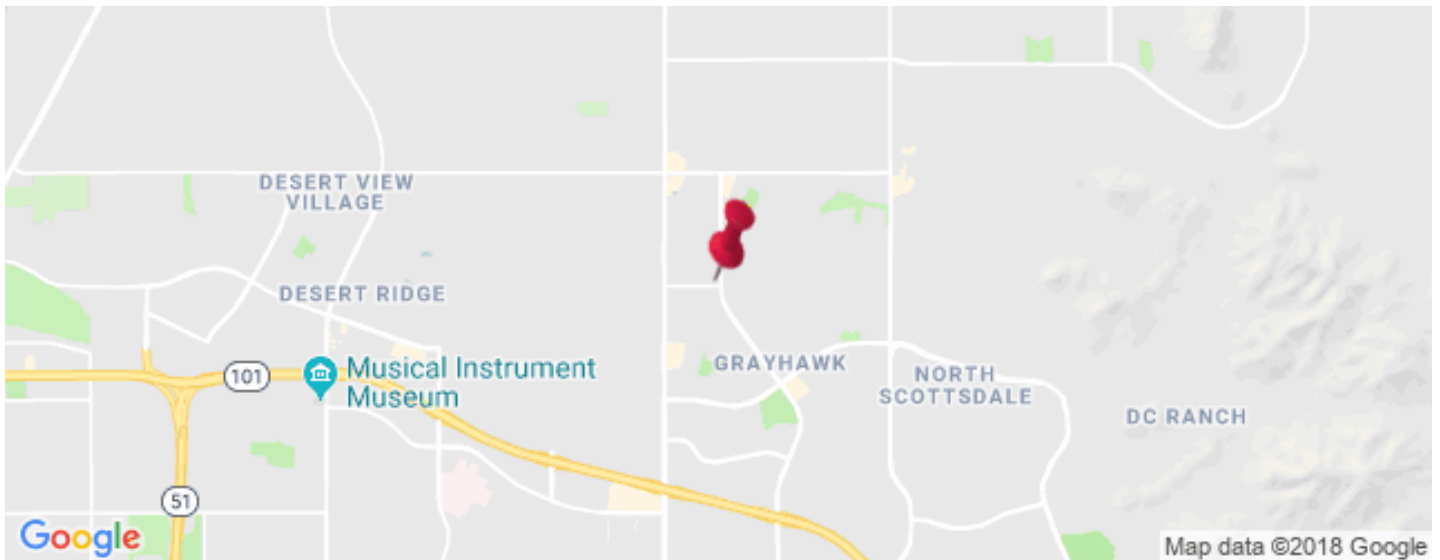
Static-Residual Hydrant



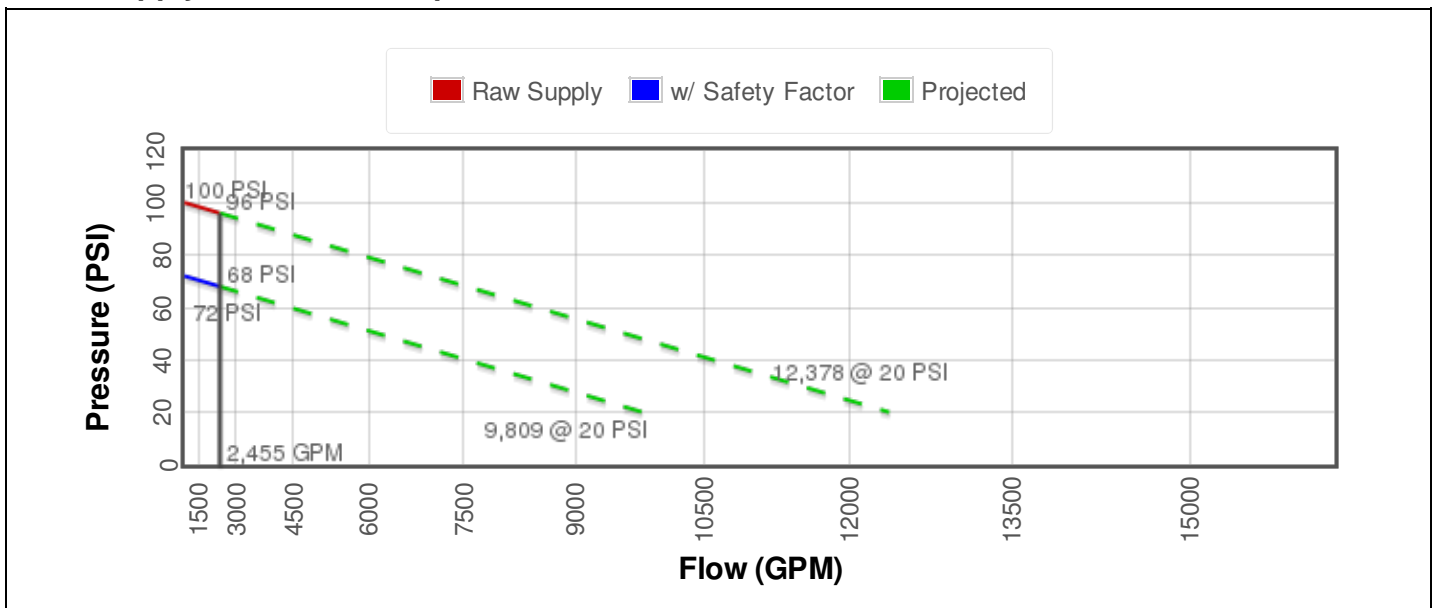
Flow Hydrant (only hydrant F1 shown for clarity)



Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



APPENDIX B
PRELIMINARY GRADING & DRAINAGE PLAN

Flow	
Q= CIA**	Q = Flow (cfs)
	C = Average Runoff Coefficient*
Q = 0.94 x 8.05 x 0.68	I = Precipitation Intensity (100-yr, 5-min) (in/hr)
Q = 5.15 cfs	A = Net Area of Disturbed Area (ac)

*C-Values are from FCDMC Hydrology Manual

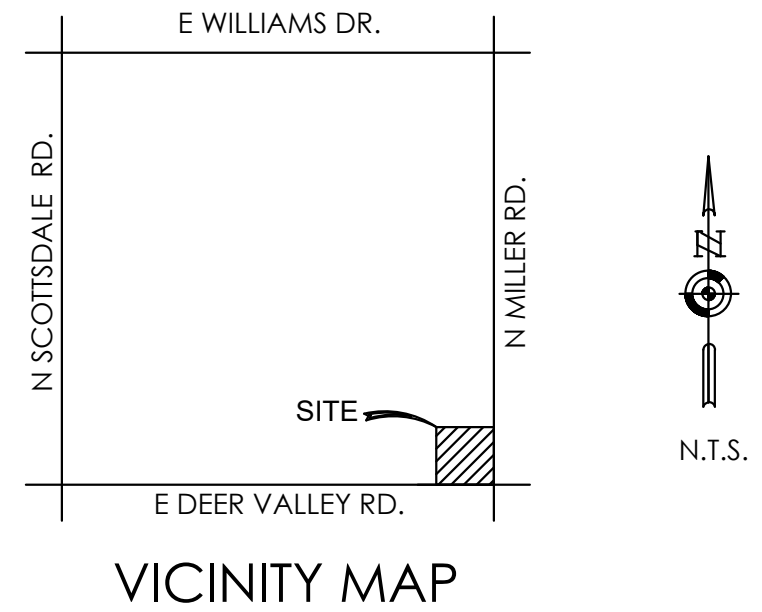
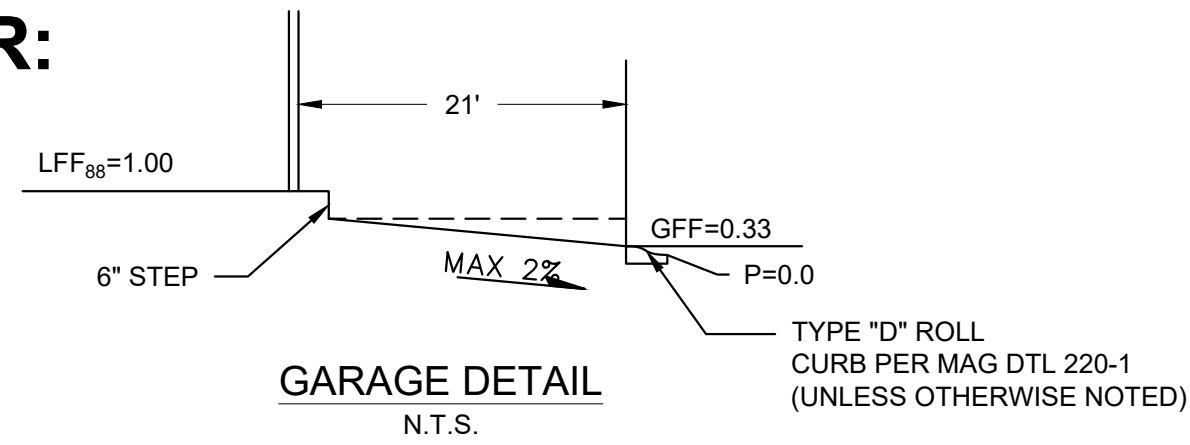
First Flush Volume	
V= CDA**	V = First Flush Volume (cf)
	C = Average Runoff Coefficient*
V = 0.94 x 0.042 x 29,597	D = First Flush Precipitation Depth (1/2") (ft)
V = 1,168 cf	A = Net Area of Disturbed Area (sf)

*C-Values are from FCDMC Hydrology Manual

**First Flush equation is from COS Design Manual

PRELIMINARY GRADING AND DRAINAGE PLAN FOR: DEER VALLEY TOWNHOMES N MILLER ROAD & E DEER VALLEY ROAD SCOTTSDALE, ARIZONA

A PORTION OF THE SOUTHWEST QUARTER OF SECTION 14, TOWNSHIP 4 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA.



OWNER / DEVELOPER

BEARDSLEY 22, INC
222 W LINGER LN, PHOENIX, AZ 85021
CONTACT: SCOTT WARD
PHONE: (480) 899-4330
EMAIL: WARDDEVELOPMENT@YAHOO.COM

ARCHITECT

WHITNEYBELL PERRY, INC
575 W CHANDLER BLVD, SUITE 123
CHANDLER, ARIZONA 85224

CONTACT: TERESA HILL
PHONE: (480) 857-8364
EMAIL: TERESA@WHITNEYBELLPERRY.COM

CIVIL ENGINEER

TERRASCAPE CONSULTING
645 EAST MISSOURI AVENUE, SUITE 160
PHOENIX, ARIZONA 85014

CONTACT: LISA NELSON, P.E.
PHONE: (480) 454-1807
EMAIL: LNELSON@TERRASCAPE.US

PROJECT DATA:

APN: 212-02-010E
NET AREA: 0.68 ACRES
TOTAL DISTURBED AREA: 0.68 ACRES
PARCEL AREA: 1.00 ACRES

ADDRESS: 21818 N MILLER RD,
SCOTTSDALE, AZ 85255

BASIS OF BEARING

THE SOUTH LINE OF SECTION 14, TOWNSHIP 4 NORTH, RANGE 4 EAST. SAID LINE HAVING AN ASSUMED BEARING OF N 89° 32' 09" E.

BENCHMARK

A CITY OF SCOTTSDALE BRASS CAP IN HANDHOLE AT THE INTERSECTION OF SCOTTSDALE ROAD AND DEER VALLEY ROAD, C.O.S ELEVATION = 1747.03 (NAVD 88).

FEMA FLOOD INFORMATION

FLOOD ZONE DESIGNATION "X" F.E.M.A. FLOOD INSURANCE RATE MAP, MAP NUMBER 04013C1320L, PANEL 1320 OF 4425, DATED AUGUST 25, 2017. ZONE "X" AREAS DETERMINED TO BE OUTSIDE OF 0.2% ANNUAL CHANCE FLOODPLAIN.

LEGEND

---	BOUNDARY	⊗	REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION
---	EX PROPERTY LINE	⊙	CLEAN OUT WITH COLLAR
---	SETBACK	⊖	CLEAN OUT
---	EASEMENT	⊗	VALVE
---	STORM DRAIN	⊙	4" MANHOLE
S	SANITARY SEWER LINE	⊙	CATCH BASIN
W	DOMESTIC WATERLINE	⊙	YARD DRAIN
FW	FIRELINE	⊙	BACKFLOW PREVENTER
⊙	DRYWELL	⊙	WATER METER
⊙	STORMTECH RETENTION TANK	⊙	BLOWOFF VALVE
---	GB GRADE BREAK LINE	⊙	FINISHED GRADE
---	EROSION SETBACK	⊙	HEC-RAS CROSS SECTIONS
⊙	FIRE HYDRANT	⊙	WATER SURFACE ELEVATION
		⊙	COLORLED PORTLAND CEMENT CONCRETE

ABBREVIATIONS

BFP	BACKFLOW PREVENTION	MH	MANHOLE
BLDG	BUILDING	P	PAVEMENT
C	CONCRETE	PROP	PROPOSED
C&G	CURB AND GUTTER	PUE	PUBLIC UTILITY EASEMENT
CO	CLEAN OUT	RW	RIGHT OF WAY
CMP	CORRUGATED METAL PIPE	RPPBP	REDUCED PRESSURE PRINCIPLE BFP
DIA	DIAMETER	SB	SETBACK
EL/ELEV	ELEVATION	SS	SANITARY SEWER
ESMT	EASEMENT	SSMH	SANITARY SEWER MANHOLE
EX	EXISTING	S/W	SIDEWALK
LFF ₈₈	FINISHED FLOOR ELEVATION	TC	TOP OF CURB
FGFW	FINISHED GRADE AT FOOT OF WALL	TYP	TYPICAL
FL	FLOWLINE	TW	TOP OF WALL
G	GUTTER	V ₂	VOLUME PROVIDED
GR	GRATE	V ₆	VOLUME REQUIRED
HP	HIGH POINT	WSE	WATER SURFACE ELEVATION
INV	INVERT	WM	WATER METER
LS	LANDSCAPE		

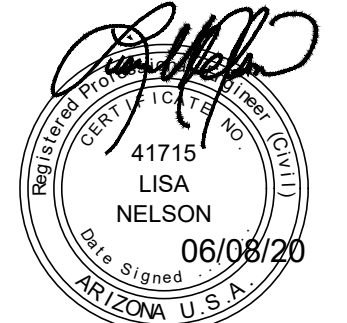
PAVING, GRADING AND DRAINAGE NOTES

- GRADE SWALE TO DRAIN
- GRADE 4" WIDE DRAINAGE SWALE TO DRAIN; LINE WITH 4" DIA. LANDSCAPE ROCK.
- 2" WIDE CURB OPENING.
- RETAINING WALL WITH SAFETY RAIL. WALL HEIGHT VARIES, PER PLAN. WALL FOOTING SHALL EXTEND BELOW TOP OF BANK TURN DOWN FOR RIP RAP, WHERE APPLICABLE ALONG EX. CHANNEL.
- EXPOSED STEM WALL; REFER TO ARCHITECTURAL PLANS.
- MIN. 2" SAWCUT AND REMOVE EX. A.C.C.P. ROADWAY. PROTECT EXISTING ASPHALT CONCRETE TO REMAIN.
- INSTALL CL-1 DRIVEWAY PER C.O.S. STD. DTL. 2256; SIDEWALK MODIFIED PER PLAN.
- SAWCUT, CLEAN EDGE, WIDEN A.C.C.P. ROADWAY TO LIMITS SHOWN.
- OBLITERATE PAVEMENT MARKINGS
- MATCH EXISTING.
- 2" DEEP RIP RAP D50 = 6" TO BE INSTALLED AGAINST RETAINING; MATCH EXISTING
- SAWCUT, REMOVE, AND DISPOSE OF CONCRETE TO LIMITS SHOWN OR NEAREST EXPANSION JOINT, EXACT LIMITS TO BE DETERMINED IN THE FIELD. PROTECT EXISTING ASPHALT CONCRETE TO REMAIN.
- INSTALL MC3500 (45" ARCH PIPE) STORMTECH RETENTION SYSTEM. SEE DETAIL SHEET 2. LENGTH PER PLAN.
- LOCALIZED INLET OVERFLOW POINT. OVERFLOW ELEV. PER PLAN.

SCALE IN FEET
0 20 40

consulting
Terrascope
civil engineering • surveying • urban planning

645 East Missouri Ave, Suite 160, Phoenix, Arizona 85012
P: 480.297.8735 • info@terrascope.us • terrascopeconsulting.com



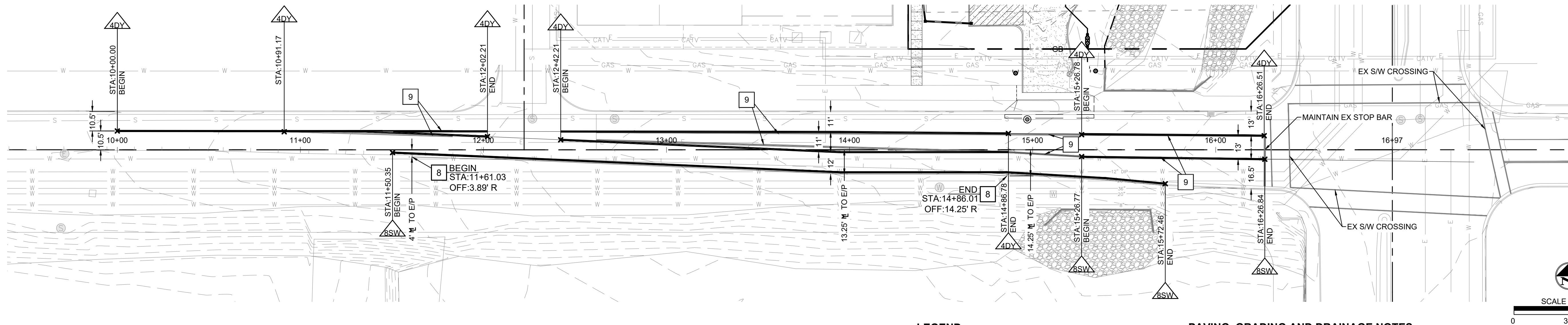
DEER VALLEY TOWNHOMES

PRELIMINARY GRADING & DRAINAGE



DATE	DESCRIPTION
08/27/18	CITY SUBMITTAL
02/06/19	CITY SUBMITTAL
03/25/19	CITY SUBMITTAL
02/06/20	2ND DRB SUBMITTAL
06/08/20	3RD DRB SUBMITTAL
CHECKED BY:	LMN
DRAWN BY:	CMA
TITLE:	PRELIMINARY GRADING & DRAINAGE PLAN
SHEET No.	1 of 2
PROJECT No.	0800

Plotted: 06/14/20 - 4:57 PM By: jhl
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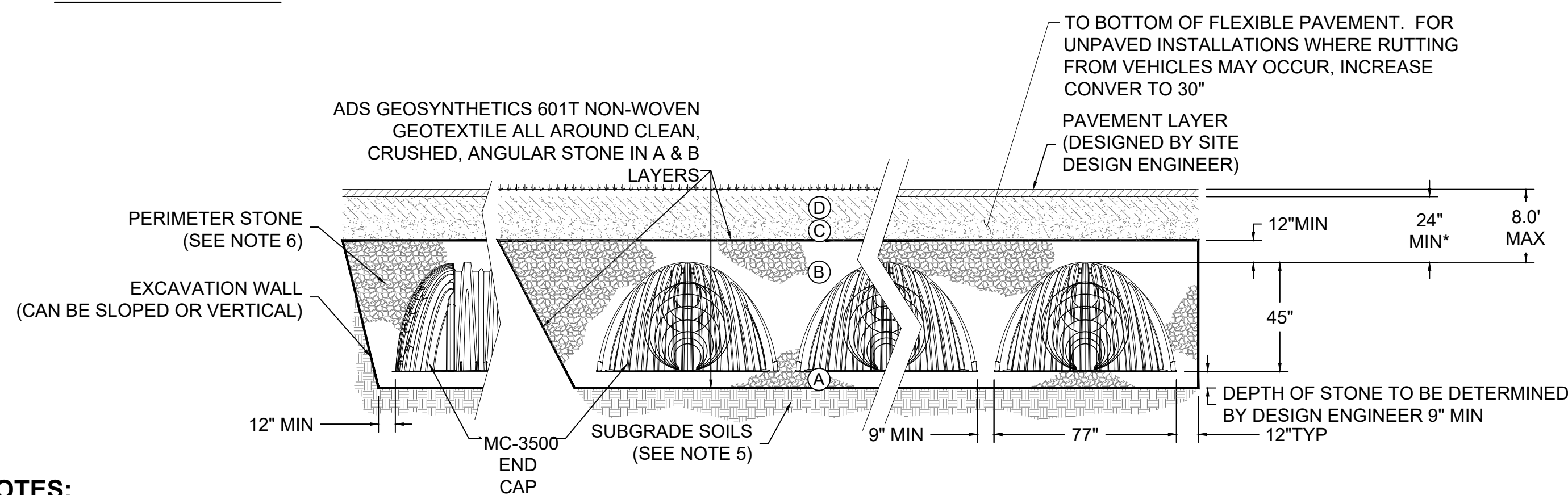
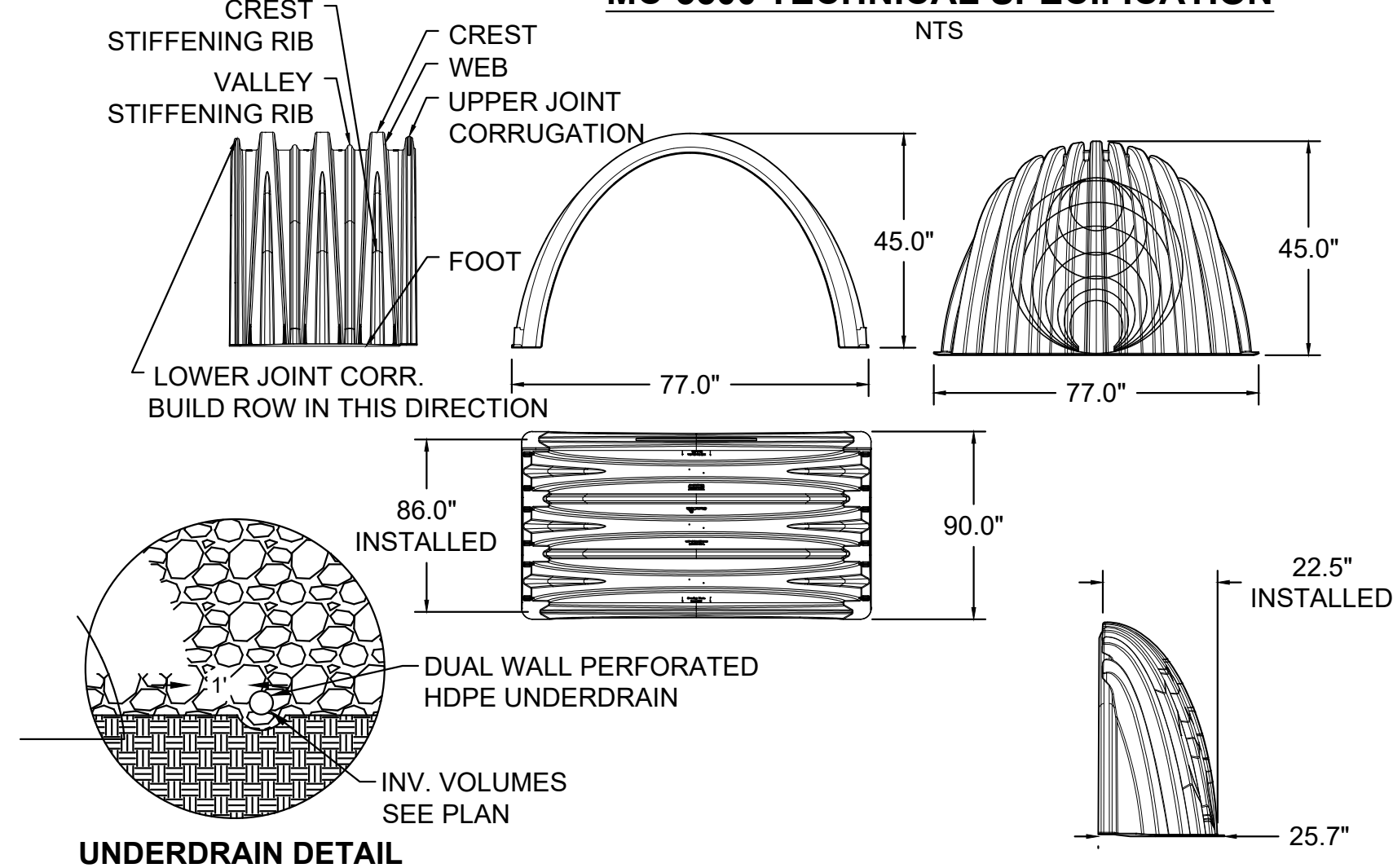
LEGEND

- 8SW 8" SOLID WHITE LINE
- 4DY 4" DOUBLE YELLOW LINE

PAVING, GRADING AND DRAINAGE NOTES

- 1 GRADE TO DRAIN
- 2 GRADE 4' WIDE DRAINAGE SWALE TO DRAIN; LINE WITH 4" DIA. LANDSCAPE ROCK.
- 3 2' WIDE CURB OPENING.
- 4 RETAINING WALL WITH SAFETY RAIL. WALL HEIGHT VARIES, PER PLAN. WALL FOOTING SHALL EXTEND BELOW TOP OF BANK TURN DOWN FOR RIP RAP, WHERE APPLICABLE ALONG EX. CHANNEL.
- 5 EXPOSED STEM WALL; REFER TO ARCHITECTURAL PLANS.
- 6 MIN. 2' SAWCUT AND REMOVE EX. A.C.C.P. ROADWAY. PROTECT EXISTING ASPHALT CONCRETE TO REMAIN.
- 7 INSTALL CL-1 DRIVEWAY PER C.O.S. STD. DTL. 2256; SIDEWALK MODIFIED PER PLAN.
- 8 SAWCUT, CLEAN EDGE, AND WIDEN A.C.C.P. ROADWAY TO LIMITS SHOWN.
- 9 OBLITERATE PAVEMENT MARKINGS
- 10 MATCH EXISTING.
- 11 2' DEEP RIP RAP D50 = 6" TO BE INSTALLED AGAINST RETAINING; MATCH EXISTING

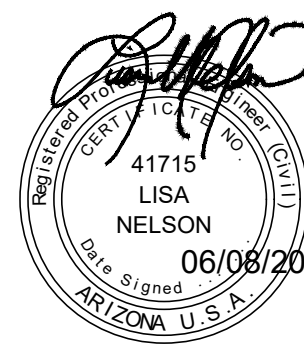
MC-3500 TECHNICAL SPECIFICATION



NOTES:

1. MC-3500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

Volume Provided			
Number of chambers	6 (1 PIPE)	Volume Per Chamber	110 cf
Number of End Caps	2	Volume Per End Cap	16 cf
Area	440 sf	Excavation Length	52 lf
Perimeter	121 ft	Excavation Width	8 lf
Stone above	12 in	Excavation Depth (Including cover)	6 lf
Stone below	9 in	NOTE: TOTAL LENGTH OF STORAGE TANK = CHAMBERS PLUS END CAPS. EACH CHAMBER IS 7.17 FT IN LENGTH AND EACH END CAP IS 1.88 FT IN LENGTH.	
Voids in stone	40 %		
Length of Isolator Row	47 ft		
Volume in chambers	# of Chambers * 109.9	659 cf	
Volume in End Caps	# of caps * 15.6	31 cf	
Volume of excavation	L X W X D	2422 cf	
Amount of stone	Vexc - Vchmb	1731 cf	
Volume in stone	Void % * Amount _{stone}	693 cf	
Amount of Filter Fabric	2*Area + Perimeter *(6+Cover)	1822 sf	
Volume Provided	V _{chmb} + V _{stone}	1352 cf	



DEER VALLEY TOWNHOMES

PRELIMINARY GRADING & DRAINAGE



DATE	DESCRIPTION
08/27/18	CITY SUBMITTAL
02/06/19	CITY SUBMITTAL
03/25/19	CITY SUBMITTAL
02/06/20	2ND DRB SUBMITTAL
06/08/20	3RD DRB SUBMITTAL

CHECKED BY:	LMN
DRAWN BY:	CMA
TITLE:	PRELIMINARY GRADING & DRAINAGE PLAN
SHEET No.	2 of 2
PROJECT No.	0800

APPENDIX C

IFC – Appendix “B”



APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.2 and B105.1(2).

TABLE B105.1(1)
REQUIRED FIRE-FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
0-3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0-3,600	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	500	1/2
3,601 and greater	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	1/2 value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

TABLE B105.2
REQUIRED FIRE-FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the <i>International Fire Code</i>	25% of the value in Table B105.1(2) ^a	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the <i>International Fire Code</i>	25% of the value in Table B105.1(2) ^b	Duration in Table B105.1(2) at the reduced flow rate

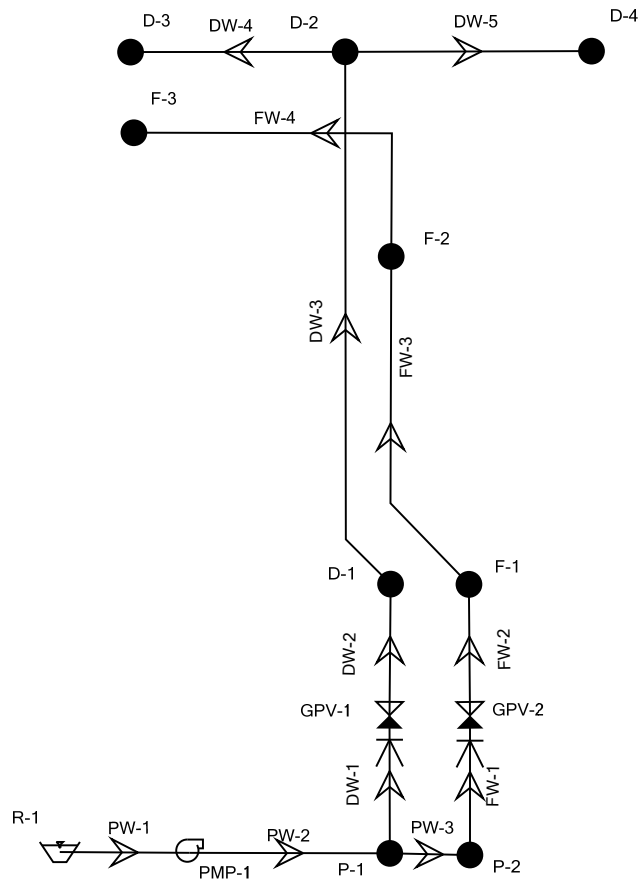
For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire-flow shall be not less than 1,000 gallons per minute.

b. The reduced fire-flow shall be not less than 1,500 gallons per minute.

APPENDIX D
WaterCAD Results

WaterCAD Network



FlexTable: Junction Table

Active Scenario: Avg. Day

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
P-1	1,774.00	0.00	1,938.28	71
D-1	1,776.09	0.00	1,926.72	65
D-2	1,778.36	0.99	1,926.69	64
D-3	1,778.37	0.99	1,926.68	64
D-4	1,778.67	0.99	1,926.68	64
P-2	1,774.00	0.00	1,938.28	71
F-1	1,775.92	0.00	1,915.19	60
F-2	1,777.97	0.00	1,915.19	59
F-3	1,778.75	0.00	1,915.19	59

FlexTable: Pipe Table
Active Scenario: Avg. Day

Label	Length (Scaled) (ft)	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Material
DW-1	31	2.0	150.0	2.97	0.30	PVC
DW-2	29	2.0	150.0	2.97	0.30	PVC
DW-3	124	2.0	150.0	2.97	0.30	PVC
DW-4	48	1.5	150.0	0.99	0.18	PVC
DW-5	55	1.5	150.0	0.99	0.18	PVC
FW-1	31	8.0	130.0	0.00	0.00	Ductile Iron
FW-2	29	8.0	130.0	0.00	0.00	Ductile Iron
FW-3	81	8.0	130.0	0.00	0.00	Ductile Iron
FW-4	85	8.0	130.0	0.00	0.00	Ductile Iron
PW-1	29	12.0	150.0	2.97	0.01	PVC
PW-2	45	12.0	150.0	2.97	0.01	PVC
PW-3	18	12.0	150.0	0.00	0.00	PVC

FlexTable: Junction Table
Active Scenario: Max Day + FF

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
P-1	1,774.00	0.00	1,933.23	69
D-1	1,776.09	0.00	1,921.64	63
D-2	1,778.36	1.98	1,921.52	62
D-3	1,778.37	1.98	1,921.50	62
D-4	1,778.67	1.98	1,921.50	62
P-2	1,774.00	0.00	1,933.16	69
F-1	1,775.92	0.00	1,903.44	55
F-2	1,777.97	500.00	1,900.32	53
F-3	1,778.75	1,000.00	1,898.76	52

FlexTable: Pipe Table
Active Scenario: Max Day + FF

Label	Length (Scaled) (ft)	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Material
DW-1	31	2.0	150.0	5.94	0.61	PVC
DW-2	29	2.0	150.0	5.94	0.61	PVC
DW-3	124	2.0	150.0	5.94	0.61	PVC
DW-4	48	1.5	150.0	1.98	0.36	PVC
DW-5	55	1.5	150.0	1.98	0.36	PVC
FW-1	31	8.0	130.0	1,500.00	9.57	Ductile Iron
FW-2	29	8.0	130.0	1,500.00	9.57	Ductile Iron
FW-3	81	8.0	130.0	1,500.00	9.57	Ductile Iron
FW-4	85	8.0	130.0	1,000.00	6.38	Ductile Iron
PW-1	29	12.0	150.0	1,505.94	4.27	PVC
PW-2	45	12.0	150.0	1,505.94	4.27	PVC
PW-3	18	12.0	150.0	1,500.00	4.26	PVC

FlexTable: Junction Table
Active Scenario: Peak Hour

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
P-1	1,774.00	0.00	1,938.28	71
D-1	1,776.09	0.00	1,926.60	65
D-2	1,778.36	3.47	1,926.28	64
D-3	1,778.37	3.47	1,926.22	64
D-4	1,778.67	3.47	1,926.21	64
P-2	1,774.00	0.00	1,938.28	71
F-1	1,775.92	0.00	1,915.19	60
F-2	1,777.97	0.00	1,915.19	59
F-3	1,778.75	0.00	1,915.19	59

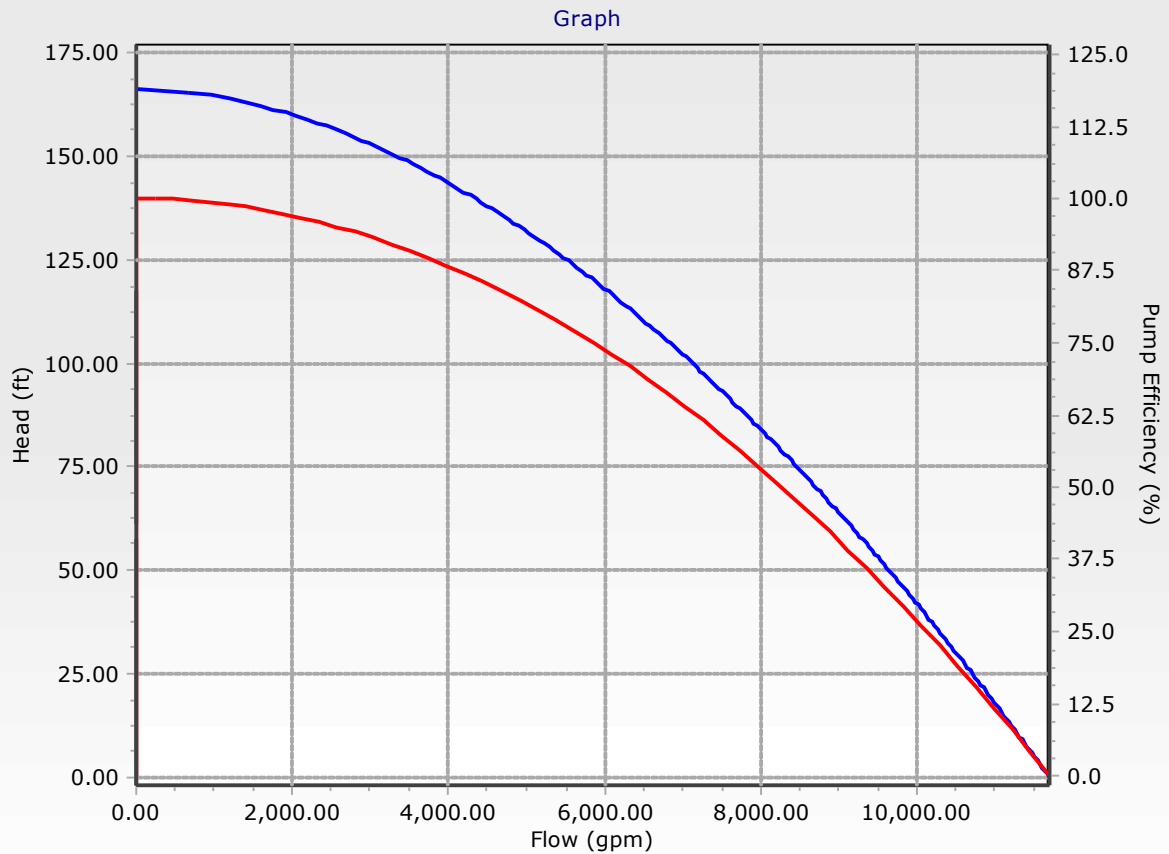
FlexTable: Pipe Table
Active Scenario: Peak Hour

Label	Length (Scaled) (ft)	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Material
DW-1	31	2.0	150.0	10.41	1.06	PVC
DW-2	29	2.0	150.0	10.41	1.06	PVC
DW-3	124	2.0	150.0	10.41	1.06	PVC
DW-4	48	1.5	150.0	3.47	0.63	PVC
DW-5	55	1.5	150.0	3.47	0.63	PVC
FW-1	31	8.0	130.0	0.00	0.00	Ductile Iron
FW-2	29	8.0	130.0	0.00	0.00	Ductile Iron
FW-3	81	8.0	130.0	0.00	0.00	Ductile Iron
FW-4	85	8.0	130.0	0.00	0.00	Ductile Iron
PW-1	29	12.0	150.0	10.41	0.03	PVC
PW-2	45	12.0	150.0	10.41	0.03	PVC
PW-3	18	12.0	150.0	0.00	0.00	PVC

Pump Definition Detailed Report: Pump Definition - 1

Element Details			
ID	56	Notes	
Label	Pump Definition - 1		
Pump Definition Type			
Pump Definition Type	Standard (3 Point)	Design Head	157.04 ft
Shutoff Flow	0.00 gpm	Maximum Operating Flow	9,809.00 gpm
Shutoff Head	166.28 ft	Maximum Operating Head	46.19 ft
Design Flow	2,455.00 gpm		
Pump Efficiency Type			
Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0.00 gpm		
Transient (Physical)			
Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True

Pump Definition Detailed Report: Pump Definition - 1



Pressure Loss from Vavle and Water Meter

Label	Elevation (ft)	Diameter (Valve) (in)	Pressure Loss (psi)
GPV-1	1,774.90	1.5	5.0
GPV-2	1,775.33	6.0	10.0